



VILLAGE OF ARTHUR GROUND WATER SURVEY

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Ministry
of the
Environment

The Honourable
George A. Kerr, Q.C.,
Minister

Everett Biggs,
Deputy Minister

MINISTRY OF THE ENVIRONMENT

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VILLAGE OF ARTHUR
GROUND WATER SURVEY

I. R. STELTNER

1976

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GROUND WATER SURVEY

VILLAGE OF ARTHUR

INTRODUCTION

The Village of Arthur requested the Ministry of the Environment to conduct a ground water survey of the area to assist the Village in locating additional well-water supplies.

This report summarizes information from existing well records, technical reports and field investigations and presents conclusions on existing ground-water conditions and recommendations for the development of additional ground-water supplies.

The area investigated in this report extends to a three-mile radius from the town-centre. Well records have been located on Drawing No. 1 and are listed in Table No. 1. Chemistry and bacteriological sample analyses of 18 wells are presented in Tables No. 2 and 3.

WATER REQUIREMENTS

The existing water works system is maintained by the Arthur Public Utilities Commission and is supplied by four wells. Three primary production wells can produce approximately 185 gpm (14 l/sec) while a fourth standby well is capable of 65 gpm (51 l/sec). An additional fifth well, rated at 130 gpm (10 l/sec) produces water of poor quality (see Tables 2 and 3) and is used only to supplement fire or peak requirements.

In peak demand periods, especially during the summer months, the total production of 250 gpm (19 l/sec) falls short of the requirements. At present, approximately 29 percent of the total production is utilized by Bell Thread Co. Ltd. but this is expected to increase another 10% once the plant expansion has been completed.

The water supply system is capable of supplying present average day demands but requires expansion to supply future water demands. Information provided by the Environmental Approvals Branch indicated that the 1998 demand of the community would require an additional 175 gpm (13 l/sec) average day and 400 gpm (30 l/sec) maximum day.

SURFICIAL GEOLOGY AND HYDROGEOLOGY

According to Putman and Champman (1972), the Village of Arthur is located on a nearly flat till plain. The till plain is comprised of a heterogenous mixture of clays

and silt with stones and boulders having a low permeability. The till sequence can vary in thickness from 150 feet (46 m) in the north to 250 feet (76 m) to the south of Arthur.

Within the till sequence, horizons of poorly sorted sands and gravels are reported. Layers of clay are observed throughout the coarser deposits. To the south of Arthur domestic wells have located water bearing horizons about 10 feet (3 m) thick. The overall water yielding capacity appears to be restricted as the horizons are limited in their lateral extent, permeability and recharge potential.

Approximately 27 of the 62 wells considered in this report located sufficient water for domestic supplies within the overburden formations at depths of about 150 feet (46 m) below ground level.

The average yield produced by the overburden wells is in the order of 12 gpm (under 1 l/sec) although a flowing well, number 104 has reported a yield of 25 gpm (2 l/sec). Overburden wells having static water levels above ground level are found along the banks of the Conestogo River primarily to the west of Arthur. The water bearing formation comprised of coarse sand and gravel occurs at an elevation of about 1280 feet (390 m) above sea level.

Some coarse saturated overburden horizons are able to supply 25 gpm (2 l/sec) but as the horizons are not uniformly saturated and are sporadic in distribution and permeability it is unlikely that these formations can yield the minimum required 175 gpm (13 l/sec) from a single well.

BEDROCK GEOLOGY AND HYDROGEOLOGY

Shale, dolomite and limestone of the Silurian Period are the dominant rock types found underlying the Arthur area. The geological sequence as interpreted from gas, oil and water well logs is as follows:

A - QUATERNARY PERIOD

Pleistocene - glacial till, moraines and drumlins about 200 ft. (60 m) thick

- rock interface is sporatically water bearing

B - SILURIAN PERIOD

Salina Formation - red and green shales with anhydrite horizons
- also brown dolomite about 30 ft. thick (9 m)

Guelph Formation - grey brown limestone and dolomite with reefal and bioherm structures

- jointing and porous zones present
- water bearing in most areas
- some dark dolomite in lower strata
- about 300 feet (90 m) thick
- gradational contact

Amabel Formation - grey, tan crinoidal limestone, some black dolomite

- about 60 feet (18 m) thick

Cabot Head Formation - grey and red shale with gypsum

- about 40 feet (12 m) thick

Drawing No. 2 shows most of the Arthur area is underlain by the Salina Formation, shales and brown dolomite, save the north-east corner of the study area where the Guelph Formation occurs. The bedrock surface also presented in Drawing No. 2 is relatively flat and sloping westward.

The Salina Formation is not fully developed in this area as the anhydrite deposits are not generally encountered. When anhydrite is present it contributes sulphates to the water which is in contact with the formation. Generally the Salina Formation is about 10 to 50 feet (3 to 15 m) thick.

The Guelph Formation underlies the Salina Formation and is composed of medium crystalline dolomite and limestone. The lower zones have been described as containing dark bituminous limestone strata but are not continuous over the area.

Because a gradational sequence occurs between the Guelph and the underlying Amabel Formation the contact is often not recognized in down hole drilling. For this reason the Guelph Formation and the Amabel Formation is reported to be about 360 feet (110 m) thick. Zones of bituminous limestone are also found within the Amabel Formation.

When the bituminous layers occur within a saturated sequence the water which is contained in the formation is expected to have elevated concentrations of sulphate which could make the water undesirable for drinking. Well No. 2124 appears to have located these strata at about 300 feet (90 m) below grade.

The Cabot Head Formation is comprised of red and green shales with gypsum

deposits. The thickness of this formation is estimated to be about 40 feet (12 m). Characteristically the water from this formation is unsuitable for drinking due to elevated sulphate concentrations. Within the Arthur area the Cabot Head Formation is expected to be situated at a depth of 500 feet (150 m) below grade.

Water yielding zones, or aquifers if they are economical, within the bedrock are limited to bedding planes, fracture zones and porous horizons. Their interconnection limits the ultimate yield of a bedrock well. The overall permeability of the rock can vary tremendously from site to site.

The first water bearing horizon encountered below the overburden till sequence occurs at the rock interface. Approximately 70 percent of the 35 bedrock wells find sufficient water supply at this zone for domestic use. The average yield of these wells is in the order of 18 gpm (1 l/sec).

Nine well records report having penetrated beyond 50 feet (15 m) into the rock to locate sufficient water and yields of 15 gpm (1 l/sec) can be found. The water at these depths is extracted from the dolomites of the Guelph Formation.

The municipal wells producing about 216 gpm (16 l/sec) find water within the Guelph Formation at depths between 300 feet and 370 feet (90 and 110 m) below grade and about 140 feet to 160 feet (43 to 49 m) of rock penetration. These wells do not report any bituminous strata within the limestone. Only Well No. 1 of the P.U.C. penetrates beyond this depth to about 500 feet (152 m) below grade, probably to intersect the Cabot Head Formations. The yield is as high as 130 gpm (10 l/sec) but the water quality is poor (Table 2).

Based on the available data it appears that the bedrock aquifers within the Guelph Formation offer the better potential for finding the additional water requirements of 400 gpm (30 l/sec). The total yield may not be available from one well and possibly two wells may ultimately be required to supply the present maximum day demands.

WATER CHEMISTRY

Water samples were randomly collected at 18 wells; nine bedrock wells and nine overburden wells. The results are summarized in Table 2.

Generally the water quality is good and suitable for municipal use. Sulphates may be elevated but generally do not exceed MOE standards. The concentration of iron

may vary from .05 ppm to 3.0 ppm and treatment processes may be required to reduce these concentrations to acceptable levels. Ground water quality in the Arthur area appears to deteriorate with depth.

Although the upper Guelph Formation may yield good quality water, on approaching the contact with the underlying Cabot-Head shales significant sulphate effects on the water render the water unacceptable for municipal purposes (see Table 2).

Bacteriological analyses were completed at the above 18 sites and are listed in Table 3. These results indicate a low bacteriological population in the deeper aquifers and therefore a limited susceptibility to contamination from the surface. The effects occur throughout the area.

The sewage lagoon located to the east of Arthur is of a retention design. It is located on the till sequence and leakage of effluent has not been observed to be a problem.

CONCLUSIONS

In summary the main aquifers encountered within the Arthur area occur as granular material within the overburden till formations, the overburden rock interface and throughout the Guelph-Amabel Formation.

The overburden aquifers have never been systematically explored to determine their true potential. Based on the existing data, the limited permeability and lateral extent, wells tapping the granular horizons are not expected to yield in excess of 40 gpm (3 l/sec) on a perennial basis.

Bedrock aquifers offer the better potential for developing additional ground water supplies. The rock aquifers are more persistent throughout the area, although when penetrating in depths in excess of 400 feet (120 m) the risk of encountering poor water increases. Wells having yields of up to 85 gpm (6 l/sec) are presently in production and the corresponding water quality is suitable for municipal distribution. Iron treatment may be required.

Bedrock aquifers in the Arthur area are likely capable of yielding the sufficient water quantity to meet the additional long term water requirements of 400 gpm (30 l/sec). The possibility exists that more than one well will be required to

develop the additional water supply.

A test drilling program evaluating the aquifers within the Guelph-Amabel Formation should be carried out within areas outlined in Drawing No. 2. The drilling program should include testing of water yielding overburden formations. Test hole depths greater than 400 feet (120 m) are not recommended. The testing program should also be designed to determine the optimum well spacing with regard to limiting the amount of mutual well interference to the existing municipal supply wells. Based on those findings, the aquifer can then be developed to its fullest potential.

Priority should be given to sites which are nearest the existing well supply system and where the interference with those wells is minimal.

FAVOURABLE TEST DRILLING AREAS

Outlined in Drawing No. 2 are three areas which offer the best potential for locating additional water supply of good quality in close proximity to the existing water distribution system but remote to the existing production wells to minimize mutual interference.

Area 1, located east of Highway No. 6 and north of Highway No. 9 should be drilled initially. The overburden is expected to be approximately 200 feet (60 m) thick. Either shale or limestone could be encountered. The main water bearing horizon is located within the Guelph-Amabel Formation at a depth of about 300 feet (90 m). Granular horizons are reported within the overburden and testing of these should also be considered. The water quality is good but iron concentrations could be as high as 3.0 ppm Fe. Although the sewage lagoon area may not be the most aesthetic for locating municipal wells, the thickness of the impermeable overburden till formation is sufficient to prevent contamination.

Area 2, located south of Highway No. 6 and east of Highway No. 9, is a little more remote from the existing distribution system. Overburden can be up to 250 feet (75 m) deep. Water bearing granular horizons can be expected at depths of about 100 feet (30 m) and 240 feet (70 m). Limestone is encountered and water bearing formations occur at an overall depth of about 250 feet (75 m) to 300 feet (90 m). Iron concentrations within the water are expected to be lower than found in Area 1. The utilization of both overburden and bedrock aquifers could likely increase the overall


per well.

Area 3 is located south of the Conestogo River and the Village of Arthur along Highway No. 9, west of Highway No. 6. Similar overburden conditions prevail as in Area 2. Granular horizons can occur at depths of about 50 feet (15 m) and 150 feet (45 m). Bedrock consists of limestone and water bearing zones can occur at a depth of about 300 feet (90 m). The water quality within the overburden is good but the possibility of encountering elevated sulphate concentrations in the bedrock increases with the distance west of Highway No. 6. The poor water from the rock when mixed with the better water from the overburden could result in a useable water supply.


RECOMMENDATIONS

If it is decided to further expand the existing ground water supply system, it is recommended that test drilling be undertaken at sites shown in Drawing No. 2.

REPORT BY:


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Table / Summary of Water Well Records

ARTHUR GROUND WATER SURVEY

Well No	Location and Elevation	con	lot	Owner	Driller	year	Well Type	Well Diameter (inches)	Depth (feet)	Static Level (feet)	Pumping Test (gpm, hrs)	Pumping Level (feet)	Quality	Use	Remarks Log etc
2	ARTHUR VILLAGE 1500			WELL #2 VILLAGE OF ARTHUR	GRAHAM	50	☉	10	288	30	8 70	130	FR	#2 MUN	0 ft 115 cl 35 f ad 50 cl 60 cl ad 155 # 285 155 gr, alt 159 12/83 11/87 12 288
3	1502			A. HARBOTTLE	DURHAM	63	☉	4	179	60	10 19	75	FR	D	0 to 4 gr, bld: 20 cl 40 40 sty cl 100 cl 115 # 162- 115 ad 150 ad 161 12/17 179
4	1515			WELL #4 VILLAGE OF ARTHUR	GRAHAM	66	☉	10	372	35	1 1/2 85	235	FR	MUN	0 to 1 cl 60 cl 100 cl 160 # 300- 60 cl 100 cl 160 cl 164 cl 164 164 cl 164, ad 168 12/3 72 372
1	1510			WELL #1 VILLAGE OF ARTHUR	IWS	32	☉	8	500	30	-	182	FR	#1 MUN	0 cl 37 f ad 41 cl 41, ad 48 # - 48 cl 41, bld: 97 f ad 103 cl 107 cl 112 122 f ad 137 cl 137, gr 158 f ad 164 cl 188 188 mud 191 gr, ad mud 195.5 ad 202 16 500
13	ARTHUR TWP 1527	I	24	R. GORVETT	DAVIDSON	54	☉	4	360	18	8 6	92	FR	D S	0 cl 1 cl, 103 hp 111 ad 148 # 293, 148 hp 152 63 60 360
14	1515	I	27	G. EDEN	DURHAM	63	☉	4	200	32	4 10	50	FR	D S	0 to 5 gr, 100 cl 160 # 185 60 cl, gr 100 f ad 125 cl 160 160 cl, ad 181 12 200
24	1426	III	29	N KIDNIL	DURHAM	63	☉	4	150	Flow +	4 10	40	FR	D S	0 DUB 20 cl 70 ad, gr 85 # 145- 85 cl 144 cl ad 149 150
27	1442	IV	29	E. SMALL	SANDER	64	☉	5	163 1/2	Flow +	- 27	-	FR	D S	0 to 4 cl 23 ad 42 cl 60 # 162 60 mud 151 cl 175 cl 185 185 mud 197 ad 151 cl 162 162 cl ad, gr 163 1/2
88	1475	FOSE	28	J. McCABE	DAVIDSON	62	●	4	144	15	4 15	32	FR	D S	0 DUB 7 hp 32 cl 105 mar 126 # 144 126 hp 135 cl ad 144
89	1470	FOSE	35	R. RANDALL	DAVIDSON	51	☉	4	263	Flow +3	- 25	-	FR	D S	0 cl 63 till 191 12 263 # 230, 263
99	1480	WOSK	30	J. McCABE	DAVIDSON	62	☉	4	202	34	5 10	50	FR	D S	0 cl 8 ad 24 cl 58 hp 95 # 222 95 ad 105 ad 196 12 222
100	1480	WOSK		S. SHARPE	DURHAM	64	☉	4	212	28	10 15	35	FR	D S	0 DUB 22 cl 100 ad 150 # 205- 150 ad 180 f ad 210 cl 205 212 205 f gr 212

Table 2 Summary of Water Well Records

Prepared by

Well No	Location and Elevation	con	lot	Owner	Driller	year	Well Type	Well Diameter (inches)	Depth (feet)	Static Level (feet)	Pumping Test (gpm) (hrs)	Pumping Level (feet)	Quality	Use	Remarks Log etc
101	1475	WOSA	32	D. FAIRBANK	SAUDER	60	●	5	190	18	18 ⁴	35	FR	D S	0 Du 52 cl, 200 62 cl 104 # 190 104 ad, cl 130 ad, cl 144 hp 180 180 cu ad, cl 189 cl 190
103	1460	WOSA	35	PENTECOSTAL CAMP	HADCO	61	■	30	19	14	4 ¹	19	FR	D	0 to 1 cl 9 q 19 # 9- 19
104	1435	WOSA	35	PENTECOSTAL CAMP	DURHAM	62	♂	5	140	FLOW	225 ⁻	-	FR	D P	0 to 2 cl 105 cl, bld r 125 # 140 125 ad 132 q 140
3297	1475	WOSA	34	M. WAGNER	GADKE	69	●	5	421	24	15 ²	35	FR	D S	0 to 2 cl 30 hp 190 q 200 # 412- 200 ad 205 cl 421 420
3566	VILLAGE OF ARTHUR 1500	I	4	N PITIRRI	CERATA	69	●	5 1/4	151	25	4 ⁴	145	FR	D	0 cl 95 ad, cl 96 ad, bld r 147 # 147- 147 q 1, ad 151 151
3466	ARTHUR TP 1475	6W	35	W. LIGHTHEART	DURHAM	69	●	4	220	4	10 ²	52	FR	D S	0 to 5 q 1, bld r 45 ad, cl 70 # 200, 70 ad, q 100 cl, q 120 q 160 220 160 ad, q 172 cl 220
3603	VILLAGE OF ARTHUR 1480			ARTHUR PUC	IWS	69	⊗	2	189	22	5	54	FR	AB.	0 cl 7 cl, q 1, ad 19 cl, q 37 # 80 37 ad, q 38 cl, q 80 ad, q 116 116 cl 189
3637	VILLAGE OF ARTHUR 1480			WELL #5 ARTHUR PUC	IWS	70	⊗	10	350	33	61 ⁷	175	FR	*5 MUN	0 cl, q 16 cl, ad, q 180 cl, q 186 # 240 186 cl 350
3977	TOP OF ARTHUR 1500	ROSE	27	P. SPARK	LADCO	71	●	4	190	43	11 ¹	44	FR	D S	0 cl, ad, 174 cl, q 182 # 189 182 cl 190
3798	ARTHUR TP 1475	6W XIX	35	ZAI & AMMO	KEESD	70	●	5	168	33	12 ^{2 1/2}	35	FR	D	0 to 3 q 1, cl 7 cl 147 # 165 147 q 1, cl 157 q 1, q 168
2880	GARAGRATA TP. 1535	I	36	H. SARTISSON	DAVIDSON	59	●	4 1/4	308	70	18 3 3/4	180	FR	D S	0 cl 60 ad, ad, 148 # 308 148 hp, ad 245 ad 247 cl 308
2881	1530	I	36	A HOERET	GADKE	63	●	4	112	40	8 ³	40	FR	D S	0 cl 45 ad, q 112 # 112

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Table 3 Summary of Water Well Records

Date

Prepared by

Well No	Location and Elevation			Owner	Driller	Well Type	Well Diameter (inches)	Depth (feet)	Static Level (feet)	Pumping Test (gpm) (hrs)	Pumping Level (feet)	Quality	Use	Remarks Log etc
	con	lat			year									
2883	1515	I	37	J. PARKS	DAVIDSON 56	●	4	244	70	15	75	FR	D	0 dug, 12 cl 228 to 244 # 244
3951	1510	I	36	A. HOERET	DURHAM 71	●	4	241	28	8	28	FR	D S	0 to 2 cl, also 20 cl 60 # 232 60 ad 80 cl 120 ad 200 200 ad, q'r 230, 1/2 241 241
4521	1525	I	30	L. CHECKLEY	LUNNEY 72	●	4	175	50	10 1/2	55	FR	S	0 cl 170 q'r 175 # 175
2962	1520	II	35	R. ROTH	DURHAM 64	●	4	222	60	10 12	70	FR	D S	0 to 4 cl 50 to 100 # 180- 100 cl 140 cl bldr 160 ad, cl 180 220 180 q'r 195 cl 210 cl ad, q'r 222
2922	1525	III	33	D. MARTIN	DURHAM 63	●	4	172	36	10 20	45	FR	D S	0 dug 18 bldr 30 ad, cl 60 # 160- 60 to 100 cl 135 bldr 150 172 150 ad, cl 160 ad 165 q'r 172
A.	TOWN OF AIRTAUGH 1485			WELL #3 ARTHUR PUC										NO LOG.
2109	1450	XVI	8	J. BEER	DURHAM 63	●	4	224	35	10 20	50	FR	D S	0 dug 14 cl 25 ad, cl 150 # 150- 150 ad 175 cl 200 ad, cl 220 ad 224 222
2110	1482	XVI	10	KELLEY Bros	DURHAM 63	●	4	195	35	10 16	60	FR	D S	0 to 4 q'r, bldr 30 cl 100 # 120- 100 to 130 ad, q'r 140 ad 150 190 150 cl 170 ad 175 q'r 190 ad, q'r 195
2117	1475	XVII	9	R. WEBB	DAVIDSON 48	●	4	75	Flow	16	20	FR	D S	0 to 1 hp 28 to 29 hp 70 # 70- 70 q'r 75 75
2118	1490	XVIII	9	R. STREET	KERR 64	●	4 1/4	269	30	15 3	45	FR	D S	0 to 1 cl 72 ad, cl 168 # 267- 168 hp 265 to 269 269
2119	1475	XVIII	13	C. MORTLEY	DAVIDSON 51	●	4	202	55	10	-	FR	D S	0 to 1 hp 60 ad 126 hp 200 # 55, 200 q'r 202 202
2120	1550	XVII	14	E. COFFEY	DAVIDSON 62	●	4	108	79	5 12	80	FR	D S	0 cl 8 ad 19 hp 31 ad 40 # 108 40 hp 70 cl 105 q'r 108

Table 4 Summary of Water Well Records

Prepared by

Well No	Location and Elevation			Owner	Driller	Well Type	Well Diameter (inches)	Depth (feet)	Static Level (feet)	Pumping Test (gpm)/(hrs)	Pumping Level (feet)	Quality	Use	Remarks Log etc
	con	lat	year											
2121	1550	XVI	16	C. HANSEN	DAVISON 61	●	4	161	85	6 10	106	FR	D S	0 cl 30 hp 92 ad 100 100 hp 145 gr, m. cae 161 # 161
2123	1450	XVII	6	A. GREEN	DURHAM 62	●	4	168	Flow @ 3	20	25	FR	D S	0 to 5 ad 20 cl 100 100 hp, bldr 135 ad, gr 160 # 168 160 gr 168
2124	1475	XVIII	7	W. GARDNER H. BEER	SAUDER 61	●	5	304	46	6 11	52	FR	D S	0 to 3 cl 21 ad 30 cl 60 # 105- 60 ad, cl 272 cl, stn 105 107 105 ad, cl 107 cl 21 hp 125 cl 131 302- 131 cl, bldr 180- RECORD - MISPLACED 304
2125	1505	XVIII	10	J. GARDNER	DURHAM 64	●	4	128	25	12 15	40	FR	D S	0 to 2 cl 20 ad 60 ad, cl 60 # 127 60 ad, cl 110 ad 126 126 ad, gr 128
2126	1535	XVIII	11	F. GRAVELL	DURHAM 63	●	5	78	60	2 8	60	FR	D S	0 to 2 cl, stn 40 # 75- 40 ad 70 ad, gr 78 78
2127	1590	XVIII	12	J. MORRISON	PRATT 50	●	3 1/4	325	70	6 6	80	FR	D S	0 to 2 cl, stn 100 ad 20 # 225 20 ad, hp 30 ad, cl 100 ad 105 105 hp, bldr 50 ad 152 hp, stn 218 218 ad, bldr 226
2128	1425	XIX	5	J. KIDNEY	DAVISON 57	●	4 1/4	234	18	8 3 1/2	140	FR	D S	0 ad 38 cl 64 ad 72 # 215, 72 cl 108 ad 118 ad, hp 172 234 172 ad, gr, ad 182 cl, ad 210 210 ad 234
2129	1495	XIX	8	EXPORT PRODUCE CO	KEESO 58	●	4	403	30	8 12	60	FR	Com S	0 cl 51 gr, cl 168 cl 220 # 403 220 cl 403
2130	1510	XIX	9	S. ZEEMAN	DURHAM 64	●	4	226	32	2 20	35	FR	D S	0 to 3 cl 60 ad, cl 100 ad 110 # 219, 110 ad, gr 160 ad, cl 200 ad 220 223 210 ad, cl 223 gr 226
2131	1513	XIX	10	B. RICHARDSON	DURHAM 63	●	4	200	48	20 5	55	FR	D S	0 to 1620 hp 30 cl 55 cae ad 60 # 135, 60 cl 90 ad 135 gr 137 ad 150 cl 165 198 165 ad, cl 185 gr 200
3693	1490	XVIII	8	W. KENNEDY	LADCO 70	●	4	186	36	10	37	FR	D	0 to 1 cl, gr 5 ad 25 cl 70 # 178- 70 ad, cl, stn 90 cl, ad 113 186 113 cl, stn 119 cl, ad 168 cl, stn ad 178 178 ad, gr 186
3813	1490	XIX	8	W. WALES	COLALTA 70	●	6	142	120	2 2	137	FR	D S	0 cl 20 cl 93 cl, bldr 135 # 135, 135 cl, gr 142 142



Table 5 Summary of Water Well Records

Date

Prepared by

Well No	Location and Elevation		Owner	Driller		Well Type	Well Diameter (inches)	Depth (feet)	Static Level (feet)	Pumping Test (gpm) (hrs)	Pumping Level (feet)	Quality	Use	Remarks Log etc
	con	lat			year									
3976	1512	XH 9	L. EPOCH.	LADCO	71	●	4	280	46	5 ¹	65	FR	D	0 cl, stn, qv 234 to 280 # 278
3542	1490	XUH 11	P. TREMBLAY	HADCO	69	●	4	225	20	20 ^{1 1/2}	24	FR	D S	0 cl, h, ad 114 qv 118 # 220- 118 cl, h, 208 qv, h, ad 225 222.
3367	1525	A 23	INTER-CO MILKSH	DURHAM	69	●	4	257	48	15 ³	55	FR	COM	0 53 ad, cl 50 hp, bldr 85 # 248- 85 ad, cl 160 ad, cl 210 bldr 215 259 215 ad 240 h, 267
1958	1520	B 23	O. McPITCHE	PLATT	50	●	4	100.	34	6 ⁵	55	FR	D	0 cl, stn 14 ad 20 # 100. 20 cl, hp, stn 50 ad, cl, hp 90 90 bldr 94 hp 98 qv 100
1957	1530	B 22	P. KELLERMAN	DAVIDSON	52	●	4	48	78	5	200	FR	D S	0 cl 30 qv 90 to 269 # 491 269 h, 495
1956	1520	B 14	E. SNOWE	DAVIDSON	60	●	5	161	67	7 ⁶	78	FR	D S	0 qv 40 hp 78 ad, qv 120 # 161 120 ad, hp 133 qv, hp 148 148 hp 157 qv 161
1953	1558	A 8	L. FLEWELLING	DAVIDSON	59	●	4 1/2	261	100	12 ⁶	115	FR	D S	0 DUG B hp 43 ad, qv, stn 55 # 261 55 hp 110 ad, qv 136 ad, hp 200 200 ad, hp 227 cl 261 h.
2999	1525	I 3	J. SAUNDERS	DAVIDSON	57.	●	4	271	80	15 ⁵	25	FR	D S	0 to 65 cl, qv 42 hp 72 # 271 72 ad, qv 98 ad 124 ad 158 158 ad, hp 134 ad, qv, stn 270 cl 271
3000	1525	I 3	S. J. ALLSOP J. PENNIE	LADCO	65	●	4	324	40	10 ²	60	FR	D S	0 cl, stn 40 ad 60 cl, ad 180 # 315- 180 qv, h, 215 ad 235 h, h, 245 322 245 h, 265 h, 324



Table 6 Summary of Water Well Records

Prepared by

MOE 07-048



Table / Summary of Water Analyses

Prepared by SS.

P1 Ontario

ARTHUR GROUND WATER SURVEY

Source and Number	Location	Date Sampled	pH	Colour Hazen Units	Turbidity Jackson Units	Specific Conductance mmhos at 25°C	Total Dissolved Solids (ppm)	Total Hardness as CaCO ₃ (ppm)	Alkalinity as CaCO ₃ (ppm)	Chemical Constituents in parts per million (ppm)											Remarks	
										Chloride (Cl)	Sulphate (SO ₄)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Free Ammonia (N)	Total Kjeldahl (N)	Nitrite (N)	Nitrate (N)		Odour on Arrival
WELL 1	4585 E. SHAW	SEPT 10 1975	7.8	10	2.5	435	283	216	219	1	18	.35	50	22	10	0.9	.1	0.1	<.02	<.2	Nil	8/1x - 170-197 26.
" 2	3009 G. PRENTICE	"	7.9	20	6.5	390	254	176	213	4	3	.55	38	19	18	0.8	.2	0.3	<.02	.4	"	8/1x - 123 26.
" 3	88 J. McCABE	"	7.9	40	10	540	351	242	211	12	73	1.2	53	27	25	1.3	.2	0.3	<.02	<.2	"	9/8 - 144 252.
" 4	89 R. RANDALL	"	7.9	100	34	580	377	258	222	14	82	2.1	59	27	29	1.4	.2	0.3	<.02	<.2	"	8/1x - 230-263 L flow
" 5	1 ARTHUR PUC	"	7.7	15	5.5	2050	1353	1270	208	70	1040	.40	372	83	38	2.9	.3	0.3	<.02	<.2	"	8/1x - 530 26
" 6	2 ARTHUR PUC	"	7.9	5	1.0	580	377	264	203	9	110	.05	64	25	26	1.1	.1	0.3	<.02	<.2	"	8/1x - 285 26
" 7	104 PENTACOSYCH	"	8.0	10	1.6	450	293	174	203	2	38	.10	38	19	31	1.1	.2	0.3	<.02	<.2	"	9/8 - 140 - g/L flow.
" 8	27 SANTOWADE	"	8.1	15	3.6	405	263	148	203	1	17	.35	34	15	33	1.1	.2	0.4	<.02	<.2	"	9/8 - 162 - g/L flow.
" 9	2124 W. GARDNER	"	7.6	70	32	1750	1138	1060	188	45	870	1.6	276	90	30	2.3	.3	0.3	<.02	<.2	"	9/8 - 105-107-22 8/1x - 302-304-?
" 10	3512 P. TEENLAY	"	7.9	60	26	395	257	154	215	41	4	1.2	37	15	29	1.0	.2	0.2	<.02	<.2	"	9/8 - 220-222-g/L
" 11	220 W. WEBB	"	8.2	15	2.2	355	231	150	194	41	2	.40	26	21	26	0.9	.5	0.5	<.02	<.2	"	9/8 - 108 g/L
" 12	1956 E. SMOOK	"	8.0	16	2.2	425	276	210	216	2	15	.35	50	21	10	1.7	.1	0.2	<.02	<.2	"	9/8 - 161 g/L



Table 2 Summary of Water Analyses

Prepared by

Source and Number	Location	Date Sampled	pH	Colour Hazen Units	Turbidity Jackson Units	Specific Conductance mmhos at 25°C	Total Dissolved Solids (ppm)	Total Hardness as CaCO ₃ (ppm)	Alkalinity as CaCO ₃ (ppm)	Chemical Constituents in parts per million (ppm)											Remarks	
										Chloride (Cl)	Sulphate (SO ₄)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Free Ammonia (N)	Total Kjeldahl (N)	Nitrite (N)	Nitrate (N)		Odour on Arrival
WELL 13	2130 S. ERIKSON	SEPT 10 1975	8.0	20	4.4	370	241	164	206	41	2	50	35	18	19	0.9	.2	0.3	<.02	<.2	Nil	9/B - 29-223 g/L
" 14	3951 A. HORRET	"	8.0	60	24	390	254	179	210	41	2	1.2	41	18	18	0.8	.1	0.5	<.02	<.2	"	8/rx - 232-241-rt
" 15	3000 S. ALLSOP	"	7.9	125	42	520	338	252	233	9	43	3.0	58	26	18	1.4	4.1	0.2	<.02	<.2	"	8/rx - 315-321 - Ls
" 16	4521 L. CHECKLEY	"	8.0	5	1.2	425	276	208	218	2	15	.20	49	21	12	0.9	.2	0.2	<.02	<.2	"	9/B - 175 - g/L
" 17	2922 D. MARTIN	"	7.9	5	0.9	440	286	184	220	3	18	.05	45	18	29	0.9	.3	0.4	<.02	<.2	"	9/B - 161-172 g/L
" 18	3001 G. HOWES	"	7.9	10	20	430	280	214	224	1	11	.35	49	22	10	0.9	.2	0.2	<.02	<.2	"	8/rx - 275-282-rt
									9 3/8													
									7 Brx													

MINISTRY OF THE ENVIRONMENT

TABLE / SUMMARY OF BACTERIOLOGICAL RESULTS

PREPARED BY

	DATE	FECAL COLIFORMS	FECAL STREPTOCOCCUS	TOTAL COLIFORMS	BACKGROUND COLONIES	
1	4585 E SHAW	0	0	0	8	SEPT 10/75
2	3009 G PRENTICE	0	0	0	0	
3	88 J. McCABE	0	2	0	58	
4	89 R RANDALL	0	0	0	496	
5	#1 PUC	0	0	0	22	
6	#2 PUC	0	0	0	0	
7	104 PENTECOSTAL	0	0	0	0	
8	27 SANTONADO	0	0	0	0	
9	2124 W GARDEN	0	2	0	4	
10	3542 P. KIMBLEY	0	0	0	0	
11	2130 W. WEBB	0	0	0	0	
12	1456 E SNOWE	0	0	26	19,000	
13	2130 S LIEBMAN	0	0	0	0	

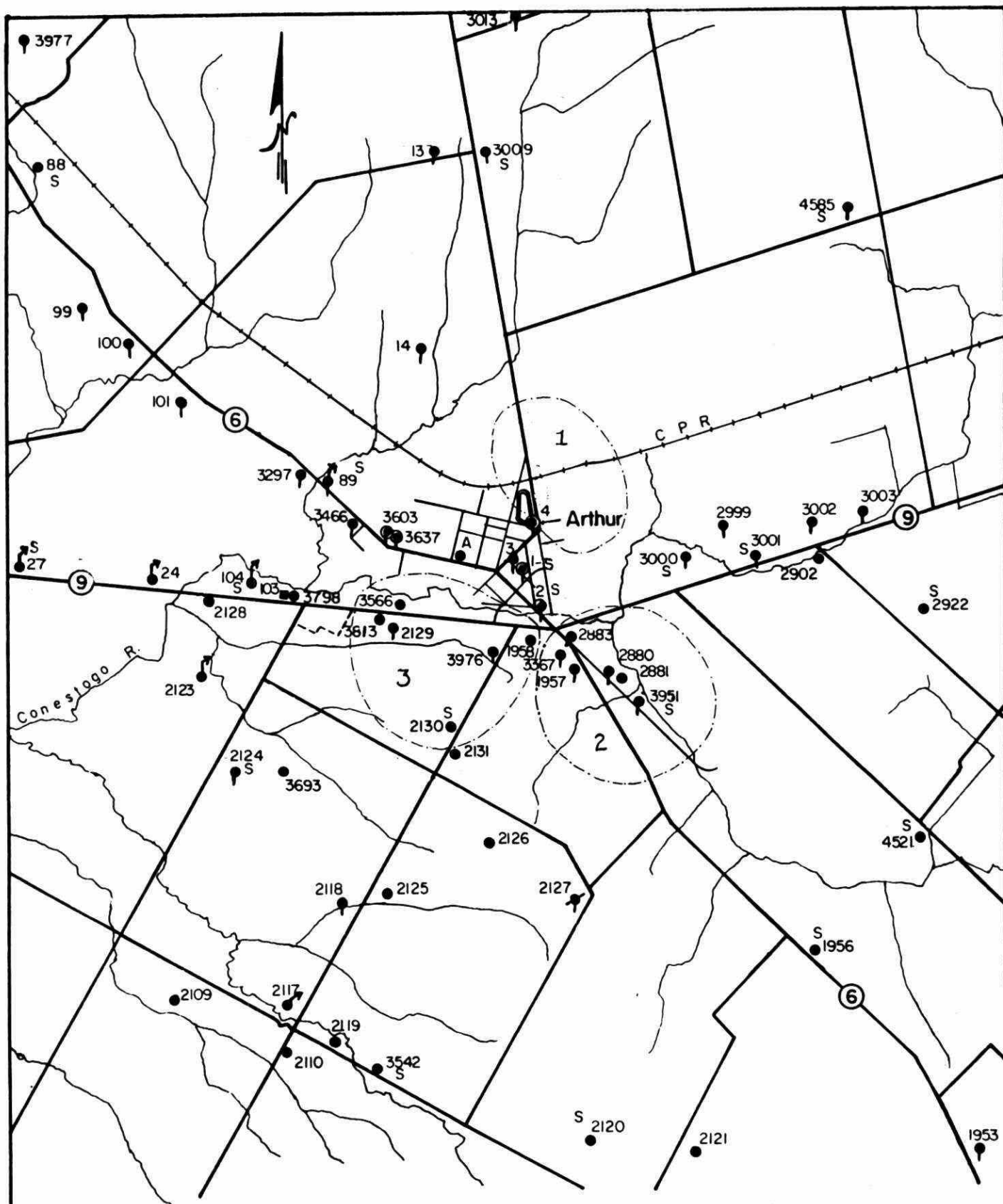
MINISTRY OF THE ENVIRONMENT

TABLE 2 SUMMARY OF BACTERIOLOGICAL RESULTS

PREPARED BY

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[illegible]



LEGEND

- Drilled well in overburden
- ⦿ Drilled well in bedrock
- ⊙ Municipal well
- Dug well
- ⌵ Abandoned well ⦿ Flowing well
- S Sample location
- Favourable test drilling area

MINISTRY OF THE ENVIRONMENT

VILLAGE OF ARTHUR

GROUND WATER SURVEY

WELL RECORD & RECOMMENDED
TEST DRILLING LOCATIONS

Date: Sept 75

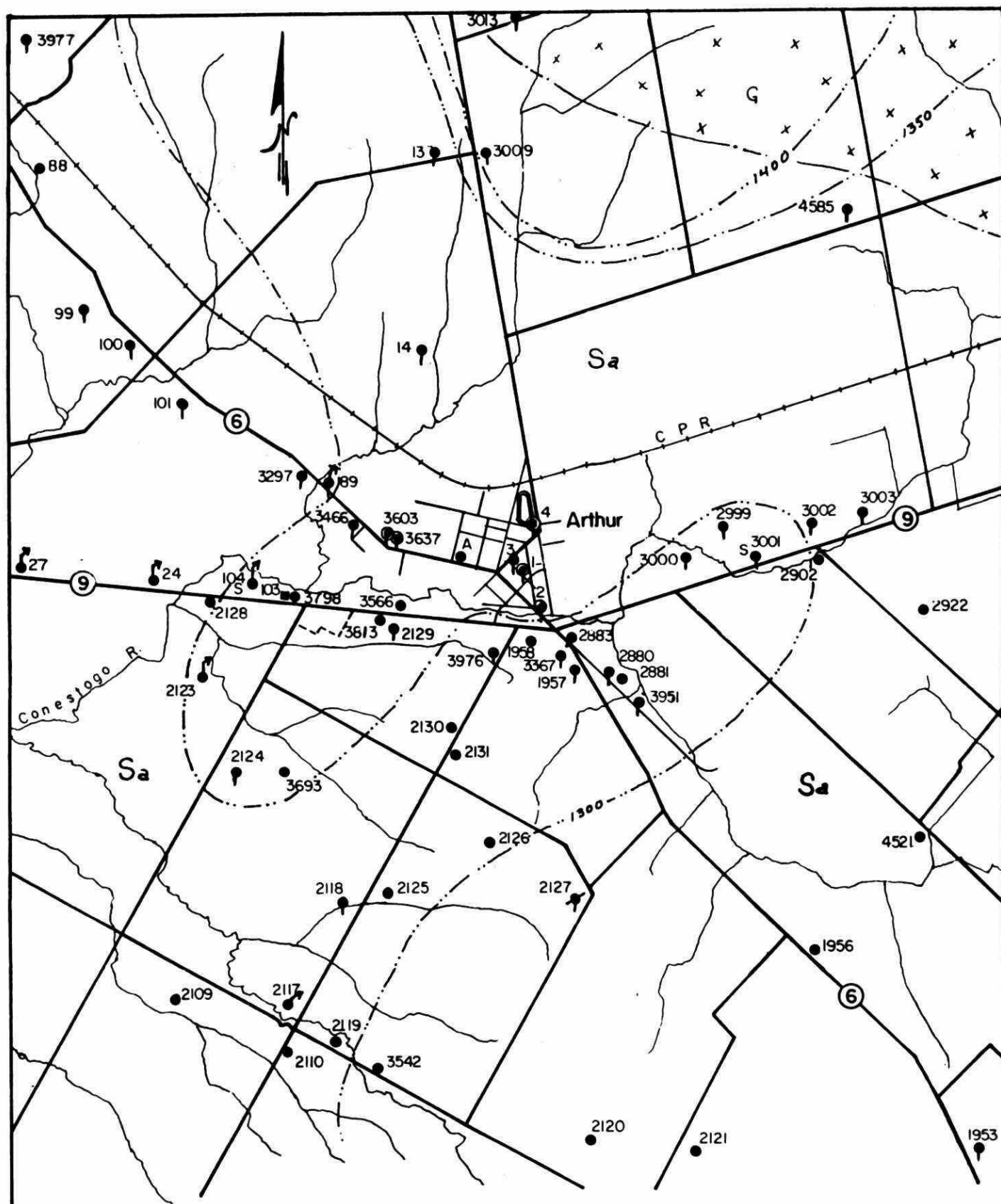
Scale:

Drawing No:

Prepared by: SFS

1 in = 0.79 mi

1



LEGEND

- Drilled well in overburden
- ⦿ Drilled well in bedrock
- ⊙ Municipal well
- Dug well
- ⦿ Abandoned well ⦿ Flowing well
- - - Guelph - Salina contact
- - - Bedrock Topography elevation above msl

MINISTRY OF THE ENVIRONMENT

VILLAGE OF ARTHUR
GROUND WATER SURVEY

BEDROCK GEOLOGY & TOPOGRAPHY

Date: Sept 75

Scale:

Drawing No:

Prepared by: SFS

1 in = 0.79 mi

2